

Maximizing Graft Diameter: Unleashing the Power of Triple-fold Hamstring Autografts for Anterior Cruciate Ligament Reconstruction



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Abstract: In this article, we explain a simple method to effectively enhance the graft size and maintain the tissue integrity of a hamstring autograft. The triple-fold technique is useful for creating a soft-tissue size and length suitable for anterior cruciate ligament reconstruction.

The use of hamstring as an autograft in anterior cruciate ligament (ACL) reconstruction has gained popularity owing to its relatively low harvest-site morbidity rates and favorable patient-reported outcomes.^{1,2} The hamstring autograft, comprising the semitendinosus and gracilis tendons, is an attractive choice given its minimal harvest-site morbidity and avoidance of the potential problem of graft-tunnel mismatch.³

However, the choice of graft type, size, and configuration plays a pivotal role in the success of the procedure. The use of only 1 graft, either the semitendinosus or the gracilis, has been attempted to preserve the remaining hamstrings.^{4,5} The use of only 1 hamstring tendon is sufficient for gaining strength in ACL reconstruction.^{6,7} In most techniques, the single hamstring tendon is applied in a quadruple-fold

configuration for ACL autograft use.^{5,6,8-10} To gain sufficient length in cases in which the graft is too short because of the quadruple configuration, we propose a triple-fold technique for preparing an ACL autograft for reconstruction.

Surgical Technique

In the described triple-fold technique, we perform graft preparation using a single semitendinosus tendon (Video 1). The 2 ends of the tendon are whipstitched using high-strength suture (Hi-Fi; ConMed, Utica, NY). The semitendinosus graft is measured and divided into 3 equal segments: proximal, middle, and distal. First, the proximal segment is folded onto the middle segment with the limbs of the whipstitches separated (Fig 1). Next, the distal segment is folded back to the middle segment, and 1 limb of the whipstitches is passed through a space between the previously folded parts of the graft (Fig 2). Finally, both whipstitches of the graft are pulled to create an equally distributed triple-folded graft for ACL reconstruction (Fig 3). In the presented case, the length of the graft is 8 cm and the size of the graft is 8 mm.

Discussion

For this technique, we focus on a 3-strand or tripled graft preparation technique, which uses only the semitendinosus tendon while preserving the gracilis tendon. This technique has several notable advantages.

Enhanced Graft Size

By folding the semitendinosus tendon 3 times, we effectively triple its diameter, increasing the overall

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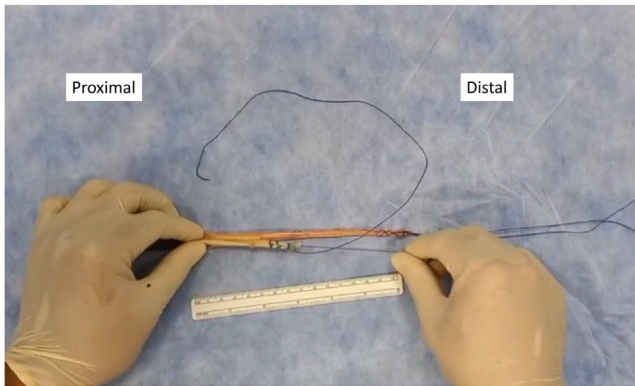


Fig 1. The proximal segment of the semitendinosus graft is folded onto the middle segment with the limbs of the whipstitches separated.

graft size. This not only contributes to greater strength but also does not shorten the overall graft length for ease of graft handling and ensures adequate graft length for fixation in both femoral and tibial fixation in the ACL reconstruction procedure.

Tissue Preservation

The technique retains the gracilis tendon, ensuring that the major tendon remains functional and intact.⁹ This not only minimizes the potential for donor-site morbidity but also preserves the patient's natural anatomy.

Stability and Biomechanical Advantages

The triple-fold graft provides enhanced stability and resistance to failure because the entire tendon is intact. This allows for stress to be shared equally within the graft. This is particularly important for patients who engage in high-demand physical activities because the graft's strength is paramount for their knees' long-term stability.

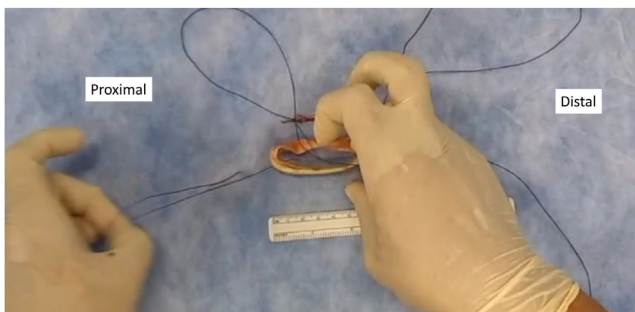


Fig 2. The distal segment is folded back to the middle segment, and 1 limb of the whipstitches is passed through a space between the previously folded parts of the graft.

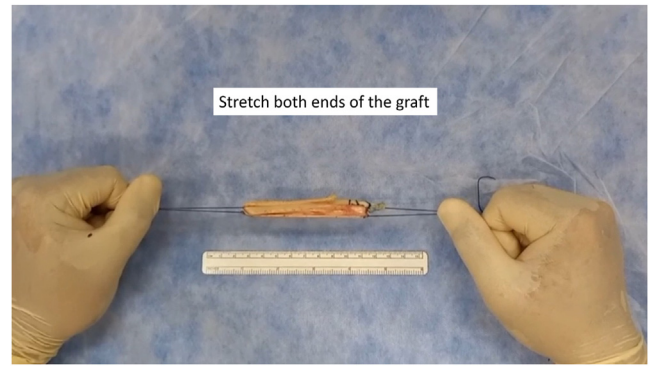


Fig 3. Final configuration of triple-fold semitendinosus graft.

Versatility

The triple-fold technique is adaptable to a variety of patient anatomies, allowing orthopaedic surgeons to individualize ACL reconstruction procedures while benefiting from the enhanced graft size. The technique also does not require extra suture material.

In many cases, 1 tendon of the hamstrings is adequate to perform ACL reconstruction.^{1,6,8,11,12} The surgeon can also perform preoperative size determination before performing harvesting of only 1 hamstring tendon. Some authors have tried to come up with methods to predict the size of the hamstring graft preoperatively.^{11,13-15} A single hamstring tendon can also be used to augment ACL repair to further strengthen and restore the femoral footprint in some situations.¹⁰

The advantages and limitations of this technique are summarized in [Table 1](#).

The triple-fold technique for preparing a single hamstring autograft for ACL reconstruction can be performed easily without the use of special devices or extra suture materials.

Disclosures

All authors (T.T., S.K., T.I., D.L., N.T., S.S., P.R.) declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Table 1. Advantages and Limitations

Advantages

- A single tendon is used to perform anterior cruciate ligament reconstruction with adequate size and length.
- The gracilis is preserved, and the technique allows for early rehabilitation.
- This is a simple and reliable method to allow for equal distribution of graft length and tension.

Limitations

- Additional graft may be required if the tendon is too small.

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